REMARKS

Reconsideration of the above-identified patent application as amended herein is respectfully requested. Claims 1-21 are amended herein and claim 22 is new. Of the claims, only claim 1 is independent. No new matter has been added.

In the Office Action of July 23, 2003, the Examiner rejected claims 1-21 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Claims 1-21 are amended herein to further clarify the invention and with consideration of the informalities noted in the Office Action, and which are now believed to overcome the rejection under 35 U.S.C. 112, second paragraph.

Specifically, the claims are amended to correct the translation problems in the application for the expression "downhand position," appearing in claims 8, 12 and 13. This is a translation of the German expression "Wannelage" which is a technical term denoting a welding position, wherein the welding beam is directed onto a workpiece essentially in the direction of gravity. The cylinder rotates about its longitudinal axis which is transverse to the direction of gravity, while the energy beam is held in a fixed position relative to the direction of the rotation of the cylinder and performs a feed movement in the direction of the axis of rotation of the cylinder. Thus, amended claim 8 now recites "...performs a continuous feed movement during the rotation in the direction of the axis of rotation to produce a **flat alloying zone**." Because of the superimposition of the rotational movement of the cylinder and the translatory movement of the energy beam device, the energy beam focus directed onto the inner surface of the cylinder

performs a spiral movement on the surface. The spiral movement eventually covers the whole of the inner surface of the cylinder, thus producing "a flat alloying zone."

According to ISO and EN standards, this position is denoted as "PA," while according to the American Society of Mechanical Engineers (ASME), this position is called "flat position," as opposed to "horizontal," or "overhead" position. Figures 1, 2, 6- 8, for example, show the energy beam being directed in the direction of gravity, transverse to the longitudinal axis of the hollow cylinder. Accordingly, the specification and the claims have been amended to replace the expression "downhand position" with "longitudinal axis transverse to the direction of gravity."

Claim 12 is amended by this amendment to be dependent on claim 1, claims 13 and 15 to 21 are amended to be dependent on claim 12 instead of claim 1, while claims 14 and 22 are now dependent on claim 13. In addition, the Specification and Figure 8 are amended herein to indicate the position of the index holes claimed in claim 12. The index holes (37) are bores, which serve to align and clamp the workpiece (33) on the clamping device (32).

In light of the amendments to the Specification, to Figure 8 and to the claims, the withdrawal of the rejection of claims 1-21 under 35 U.S.C. 112, second paragraph, is respectfully requested.

In the Office Action, the Examiner rejected the claims under 35 U.S.C. 103(a) as being unpatentable over a number of cited prior art references. Specifically, claim 12 was rejected as being unpatentable over JP 357185927A (Hayashizaki, et al); claim 13 was rejected as being unpatentable over Hayshikazi et al and further in view of US Patent 5,405,660 (Psiuk et al, hereinafter US '660), or US Patent 6,203,861 (Kar et al, hereinafter US '861); claims 1-2 and 5-

11 were rejected as being unpatentable over US Patent 6,548,125 (Warnecke, hereinafter US '125) in view of US Patent 6,299,707 (McCay et al, hereinafter US '707), optionally considering US Patent 6,221,175 (Kurz et al, hereinafter US '175) or US Patent 5,038,014 (Pratt et al, hereinafter US '014); claims 3-4 and 6 were rejected as being unpatentable over US '125 in view of US '707, optionally considering US '175 or US '014; claims 1, 3-11 were rejected as being unpatentable over US Patent 6,284,097 (Schwartz et al, hereinafter US '067), in view of US '660, optionally considering US '175 or US '014 and/or optionally considering US '861; claims 1-2 and 5-12 were rejected as being unpatentable over US Patent 6,303,897 (Bady et al, hereinafter US '897), in view of US '175 or US '014; and claims 3-4 and 13 were rejected as being unpatentable over US '897 in view of US '175 or US '014.

Applicants respectfully traverse this rejection. For the reasons set forth below, as well as for other reasons, it is believed that the amended claim 1, the only independent claim of the present application, is not rendered obvious by the prior art of record.

As set forth in amended claim 1, and as exemplified in Figure 1, the present invention is directed to a method for manufacturing a cylindrical, partly cylindrical, or hollow cylindrical surface-alloyed structural member which can be used industrially, and to a device to implement this method.

Specifically, amended claim 1 claims as follows:

"A method for manufacturing a cylindrical, partly cylindrical or hollow cylindrical surface-alloyed structural member where **an energy beam having a linear focus, is directed onto a workplace surface** ...**and a silicon powder is fed into the molten surface**, ...

b) **depositing the silicon powder at the side of the energy beam** …

c) heating the silicon powder supplied to the workpiece surface in the heating front of the melting bath ….

d) producing convection in the solution zone …so that the homogenization process in the melting front is accelerated,

f) subjecting the uniformly distributed silicon powder …"

US '125 discloses a method for coating an inner surface of a weapon barrel, in which the powdery coating material is blown by a carrier gas **into** the leaser beam for melting the coating material. Thus, US '125 teaches a method in which the melting occurs essentially **before** the coating material hits the surface of the workpiece to be coated. In addition, the coating operation is performed by directing the laser beam to the surface of weapon barrels where it melts the substrate material... Accordingly, the molten coating material and the substrate material are mixed in a molten state (see from column 2, line 66 to column 3, line 9).

To the contrary, the presently claimed invention is directed to a method in which the powder material for surface-alloying is supplied on the surface area **before** impingement of the laser beam on the surface, as claimed in amended claim 1 "**depositing the silicon powder at the side of the energy beam.**"

From a practical stand point, this is the only way to improve the wear resistance of the workpiece. Only through the convection resulting in the melt pool produced by the laser is it possible to achieve the truly uniform distribution of the silicon powder in the melt pool. In

addition, with the method of amended claim 1, it is possible to control with a high degree of precision the amount of powder alloyed into the substrate.

US '707 discloses a method to increase the wear resistance of an aluminum cylinder bore by coating the interior surface of the cylinder bore with a precursor comprising a binder and alloying elements and subsequently by irradiating the surface with a laser beam (see figure 1 and the SUMMARY OF THE INVENTION). Accordingly, the process of applying the material for surface-alloying the substrate material of US '707 is fundamentally different from the method claimed in amended claim 1 because it does not suggest "...depositing the hard material powder at the side of the energy beam......heating the hard-material powder......producing convection in the solution zone ....so that the homogenization process in the melting front is accelerated,...." The presence of the binder applied with the precursor material inhibits the uniform distribution of the alloying material, and thus, by using the method disclosed by US '707, it is impossible to achieve the convection in the melt pool as in the presently claimed invention.

US '175 discloses a method for the production of a ceramic layer on a metallic base material. The method of US '175 teaches a coating material, a base material and an additive material reacting with the coating material. The base material is heated by a laser beam before the application of a ceramic coating material to a locally melted surface region of the base material, and an additive material reacting with the coating material is additionally applied to the base material as an adhesion producing layer (see claim 1 of US '175). As shown in Figures 2 and 3 of US '175, the coating material is applied to the base material through the laser beam, which thus melts the coating material before it hits the base material surface.

Thus, the method of US '175 is very similar to the method disclosed in US '125 discussed above, and it does not suggest or render obvious the method of amended claim 1 which claims that the silicon powder is deposited at the side of the laser beam and not through it. In addition, the application of the additive material is an additional step which makes the process less suitable for an economic large scale industrial production.

US '014 discloses a process for depositing layers on a substrate material, for example, parts of a turbine. US '014 discloses in column 3, lines 59-60, and in Figure 6, that the "laser welding technique melts powders in a feed and projects the molten material onto a surface." Thus, the material to be deposited arrives on the surface in an already molten state as in US '175 and in US '125 and unlike in the presently claimed invention. Thus, amended claim 1 is not rendered obvious by US '014.

Claim 1 was further rejected as obvious over US '067 in view of US '660, optionally considering US '175 or US '014 and/or optionally considering US '861.

US '067 discloses a method of using a laser to produce alloyed bands or strips on the surface of a piston for an internal combustion engine. Like the method of US '707, US '067 discloses a precursor layer comprising a binder and a metallic or ceramic powder applied to the surface of an aluminum piston (see block 10 of Figure 1). The piston is then irradiated with a laser beam in order to produce an alloyed layer on the surface of the piston. Thus, as in the method of US' 707, the process of applying the material for the surface-alloying to the substrate material is fundamentally different from the method claimed in amended claim 1.

US '660 discloses a method for coating the steel base body of a worm or screw by introducing the coating material into a laser beam, and by directing the melted coating material and the laser beam onto the surface to be coated. However, as in the methods of US '175 and US '014, the basic teaching of amended claim 1 provides for the feeding of a silicon powder to the workpiece **before** being melted by the laser beam so to make full use of the convection in the melting pool which leads to a uniform distribution of the alloying material on the workpiece surface. This teaching is not disclosed or suggested by US '660, which therefore does not render obvious amended claim 1.

US '861 discloses a rapid manufacturing process to create three-dimensional prototyping parts. Metal, ceramics and the like powders are delivered to a laser beam-material interaction region where they are melted and deposited on a substrate. Thus, the powder 319 coming out of the feeder nozzle 395 interacts immediately with the laser beam and arrives at the substrate surface in the form of liquid droplets (see Figures 1, 5, 7 and column 6, lines 52-55). Accordingly, the teaching of US '861 has the same problems of US '125, US' 175 and US '014.

In Figure 11, the powder might not be completely molten before hitting the surface. However, the substrate is melted by the laser beam before the deposition of the powder on the substrate. In contrast, amended claim 1 claims a method in which the silicon powder is first supplied at the side of the energy beam and then the silicon powder is **supplied to the workpiece surface** and the workpiece surface underneath are at the same time. According to the method disclosed in US '861 the powder is injected directly in the melt pool, thereby passing

through the lased-induced plasma above the treated area. Due to the high temperatures in such plasma, the powder will also be essentially molten when arriving on the treated surface.

Finally, the examiner further rejected claim 1 over US '897 in view of US '175 or US '014.

US '897 discloses a process and a device for the laser treatment of the internal surface of hollow bodies, in which the alloying powder is injected into the plasma locally created by the laser. Such laser plasma occurs just above the area of impact of the laser beam on the treated surface. Accordingly, the powder material is melted in the hot plasma and penetrates the likewise molten substrate surface layer (see column 2, lines 11-24). Thus, according to this method, the powder material is also molten before it hits the surface of the substrate material and it is injected through the laser plasma into the melt pool created by the laser beam energy. Thus, the uniform distribution of the material in the substrate surface claimed in claim 1 is not achieved or suggested by the teaching of US '987.

Accordingly, as none of the cited references, alone or in any combination discloses or suggests the teaching of amended claim 1, the only independent claim of the present application, amended claim 1 and all other claims dependent upon it are not rendered obvious by the prior art of record and the withdrawal of rejections under 35 U.S.C. 103(a) is respectfully requested.

In the Office Action, the Examiner noted that US '897 and the presently claimed invention have a common inventor but different assignees, and that, if the Assignees were the same an obviousness double patently rejection would have been made over claims 1-2, 4-10 and 12. Applicants point out that both Assignees, the VAW Motor GmbH and VAW aluminium AG

belong to the same parent company, but since US '897 does not render obvious independent amended claim 1, the possibility of double patenting does not arise.

In view of the foregoing, it is believed that the present application is in condition for allowance and a favorable action on the merits is respectfully requested.

Respectfully submitted,

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Enclosures: Petition for a three month extension of time
Amended Figure 8 (Replacement Sheet)
ASME Definitions, Consumables, Welding Positions (Exhibit A)

ASME Definitions, Consumables, Welding Positions

- ASME P Material Numbers Explained

ASME has adopted their own designation for welding processes, which are very different from the ISO definitions adopted by EN24063.

Designation	Description
OFW	Oxyfuel Gas Welding
SMAW	Shielded Metal Arc Welding (MMA)
SAW	Submerged Arc Welding
GMAW	Gas Metal Arc Welding (MIG/MAG)
FCAW	Flux Cored Wire
GTAW	Gas Tungsten Arc Welding (TIG)
PAW	Plasma Arc Welding

Straight polarity = Electrode -ve

Reverse polarity = Electrode +ve

ASME F Numbers

F Number	General Description
1	Heavy rutile coated iron powder electrodes :- A5.1 : E7024
2	Most Rutile consumables such as :- A5.1 : E6013
3	Cellulosic electrodes such as :- A5.1 : E6011
4	Basic coated electrodes such as : A5.1 : E7016 and E7018
5	High alloy austenitic stainless steel and duplex :- A5.4 : E316L-16
6	Any steel solid or cored wire (with flux or metal)
2X	Aluminium and its alloys
3X	Copper and its alloys
4X	Nickel alloys
5X	Titanium
6X	Zirconium
7X	Hard Facing Overlay

Note:- X represents any number 0 to 9

Exhibit A

ASME A Numbers

These refer to the chemical analysis of the deposited weld and not the parent material. They only apply to welding procedures in steel materials.

A1	Plain unalloyed carbon manganese steels.
A2 to A4	Low alloy steels containing Moly and Chrome Moly
A8	Austenitic stainless steels such as type 316.

ASME Welding Positions Graphic Representation

Note the welding progression, (vertically upwards or downwards), must always be stated and it is an essential variable for both procedures and performance qualifications.

Welding Positions For Groove welds:-

Welding Position	Test Position	ISO and EN
Flat	1G	PA
Horizontal	2G	PC
Vertical Upwards Progression	3G	PF
Vertical Downwards Progression	3G	PG
Overhead	4G	PE
Pipe Fixed Horizontal	5G	PF
Pipe Fixed @ 45 degrees Upwards	6G	HL045
Pipe Fixed @ 45 degrees Downwards	6G	JL045

Welding Positions For Fillet welds:-

Welding Position	Test Position	ISO and EN
Flat (Weld flat joint at 45 degrees)	1F	PA
Horizontal	2F	PB
Horizontal Rotated	2FR	PB
Vertical Upwards Progression	3F	PF
Vertical Downwards Progression	3F	PG
Overhead	4F	PD
Pipe Fixed Horizontal	5F	PF

Welding Positions QW431.1 and QW461.2

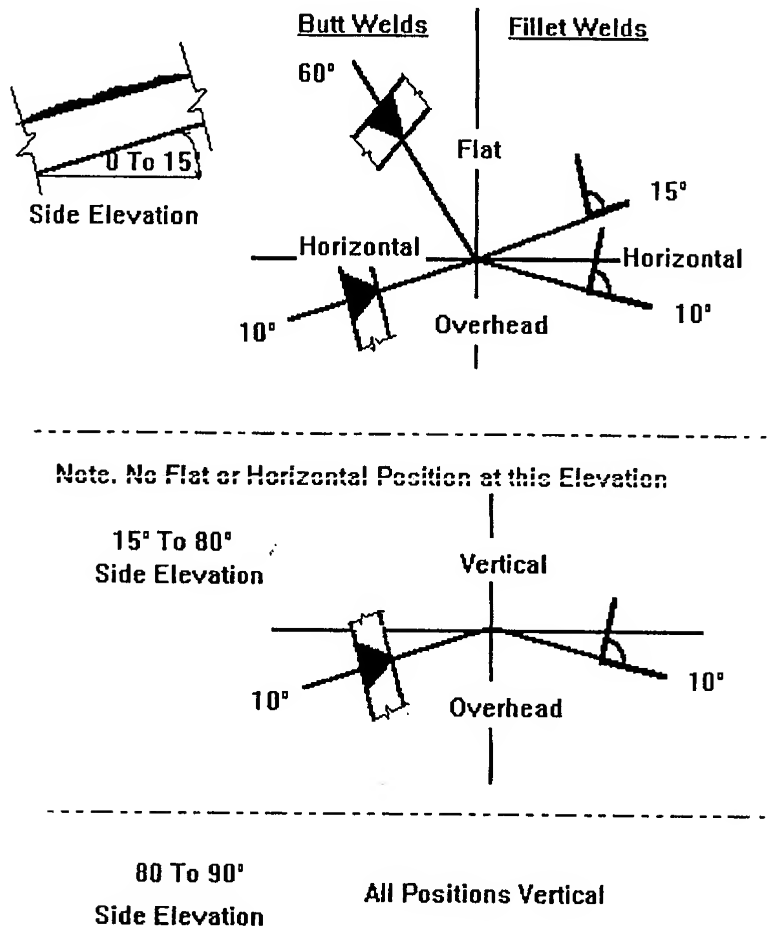
Basically there are three inclinations involved.

- Flat, which includes from 0 to 15 degrees inclination
- 15 - 80 degrees inclination

Exhibit A

- Vertical, 80 - 90 degrees

For each of these inclinations the weld can be rotated from the flat position to Horizontal to overhead.



- Brief Introduction
- Procedure Qualification Record (PQR)
- Welding Performance Qualification (WPQ)
- ASME definitions for welding processes, consumables and welding positions

- Welding Qualifications Sub Menu

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Exhibit A